Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.17814

Reducing matrix effect in LA-ICP-MS by mixing of nitrogen to helium cell gas

QING CHANG[1] AND JUN-ICHI KIMURA[2]

[1]Japan Agency for Marine-Earth Science and Technology
[2]JAMSTEC

Presenting Author: qchang@jamstec.go.jp

Adding a small amount of nitrogen to helium career gas flow in laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) reduces matrix dependent non-spectral interferences and enhances sensitivity of most elements interested in the Earth science studies. We conducted comprehensive tests on the effect of N_2 addition in determination of major, minor and trace elements of glass reference materials and constructed modelling of the plasma state using DUV femto-second laser ablation connected to high resolution ICP-MS. Under no N_2 addition mode (normal or usual operation), high thermal conductivity BHVO-2G glass showed selective suppression of the analyte signals of easily ionized elements when calibrating against SRM 61x glasses. The degree of suppression was controlled by the electron binding energy (EBE) of the element. Elements with low EBE of 14–33 eV showed relatively large signal suppression. The first-row transition metals having EBE of 33–75 eV in contrast showed almost nil elemental fractionation. Addition of ~0.2% (v/v) N_2 to cell helium flow increased plasma temperature and enhanced all elemental sensitivity in BHVO-2G resulted in significant reduction of the matrix effect when calibrated against the SRM 61x low thermal conductivity glass. It is shown that N_2 addition formed a robust plasma which is useful to reduce elemental fractionation, enhance elemental sensitivity and reducing yield of molecular ions in the plasma. N_2 addition was also applied in U-Pb dating of zircons using SRM 61x glass as the standard. The results showed excellent agreement with the reference values demonstrating the benefit of high temperature plasma with N_2 addition.